

Notice of Allowability

Application No.

09/967,176

Examiner

Gordon J Stock

Applicant(s)

ZAIDI, SHOAB HASAN

Art Unit

2877

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to correspondence filed 9/11/03 (requested faxed copies received 11/4/03).
2. ☒ The allowed claim(s) is/are 1, 2 and 4-23.
3. ☐ The drawings filed on _____ are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
 - * Certified copies not received: _____.
5. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
 - (a) ☐ The translation of the foreign language provisional application has been received.
6. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application. **THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

7. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
8. ☒ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No. _____.
 - (b) ☐ including changes required by the proposed drawing correction filed _____, which has been approved by the Examiner.
 - (c) ☒ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No. _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the margin according to 37 CFR 1.121(d).

9. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|---|
| 1 <input type="checkbox"/> Notice of References Cited (PTO-892) | 5 <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 2 <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6 <input type="checkbox"/> Interview Summary (PTO-413), Paper No. _____ |
| 3 <input type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No. _____ | 7 <input checked="" type="checkbox"/> Examiner's Amendment/Comment |
| 4 <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit of Biological Material | 8 <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| | 9 <input type="checkbox"/> Other _____ |

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Mr. Steven Slater on November 13, 2003.

As for the Abstract (page 23, beginning at line 5), please amend as follows:

A wavefront sensing tool, such as a Shack-Hartmann detector, detects alignment features in a semiconductor wafer that might otherwise be undetectable using conventional optical tools, such as a microscope. This is particularly advantageous for alignment features formed in photoresist with a height that is less than one fourth the illuminating light's wavelength. The wavefront sensing tool can be used in conjunction with a conventional optical tool[s] and a composite alignment image can be formed from the two tools. For higher sensitivity, the light reflected off the wafer can be magnified, with e.g. a telescopic lens, prior to impinging upon the wavefront sensing tool. The composite image can be generated by one or both of the tools or by a computer coupled to the tools.

As for the drawings:

the replacement drawings filed on September 11, 2003 and November 4, 2003 (a copy of the drawings received on September 11, 2003 requested due to problem images of the September

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11, 2003 documents) have been entered into the file. Specifically, corrections to Figs. 1a, 1c, 2, 4a, 5b and 6 are accepted. However, due to a facsimile signature on the drawings received on November 4, 2003, an examiner's amendment of Figs. 2, 4d, and 7 was needed to clarify the drawings. As for Fig. 2, a box was completed and designated **9**; as for Fig. 4d, the dotted line figure was made continuous and a specific area of **40** was designated **136**; as for Fig. 7, the figure was labeled 'Fig. 7.' See proposed corrections attached.

As for the claims:

Claim 1 and claim 23 are amended to remove antecedent problems; for claim 1, 'reference alignment mark' of lines 5 and 7 now reads as 'reference mark;' for claim 23, "the overlay" now reads --overlay--.

Amendment to the claims:

1.(currently amended) A method of detecting the alignment of two layers in an integrated circuit comprising multiple stacked layers of material, one underlying layer having a first alignment mark and one overlying layer having a second alignment mark, the method comprising:

detecting the first alignment mark and a reference [alignment] mark using a wavefront sensing tool and forming thereof a first image;

detecting the second alignment mark and the reference [alignment] mark using a second alignment tool and forming thereof a second image; and

forming a composite image from the first and second image by aligning the reference mark in the first and second image.

23.(currently amended) A method of detecting the alignment of two layers in an integrated circuit comprising:

detecting a first alignment feature in a first layer of an integrated circuit using a wavefront sensing tool and forming thereof a first image;

detecting a second alignment feature in a second, underlying layer of the integrated circuit using a microscope and forming thereof a second image;

forming a composite image from the first and second image; and

measuring from the composite image [the] overlay between the first and second layer.

The following amendment to the specification was not authorized by the attorney; however, due to some imaging problems with the substitute specification received on November 4, 2003 that created some typographical errors, an amendment is needed.

Specifically, on page 1 of the substitute specification of November 4, 2003 the title on line 1 should read:

A Method for Overlay Metrology of Low Contrast Features

Please amend the paragraph beginning on line 18 of page 15 of substitute specification of November 4, 2003 as follows:

Although the present invention and its advantages have been described in detail, it should be understood that various changes, substitutions and alterations can be made herein without departing from the spirit and scope of the invention as defined by the appended claims. Moreover, the scope of the present application is not intended to be limited to the particular embodiments of the process, manufacture, composition of matter, means, methods and steps described in the specification. As one of ordinary skill in the art will readily appreciate from the disclosure of the present invention, processes, manufacture, compositions of matter, means, methods, or steps, presently existing or later to be developed, that perform substantially the same function or achieve substantially the same result as the corresponding embodiments described herein may be utilized according to the present invention. As just one example, the advantageous features of the present invention could be obtained in some embodiments through the use of an atomic force microscope as one of the alignment detection tools. Accordingly, the appended claims are intended to include within their scope such processes, manufacture, compositions of matter, means, methods, or steps.

Response to Arguments

2. Applicant's arguments, see Remarks pages 18-23, filed September 11, 2003 and subsequently a copy requested by the Examiner and received on November 4, 2003 due to imaging problems of the September 11, 2003 document, with respect to objections to specification, claims, drawings, and rejections of the claims have been fully considered and are persuasive. And in light of the amendment of the claims, specification, and drawings, the rejections and objections to the drawings, claims, and specification have been withdrawn.

3. The amendment and substitute specification filed on September 11, 2003 and the requested copy of the amendment and substitute specification received on November 4, 2003 because of imaging problems with the documents received September 11, 2003 have been entered.

Allowable Subject Matter

4. **Claims 1-2, 4-23** are allowed.

5. The following is an examiner's statement of reasons for allowance:

As to **claim 1**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in method of detecting the alignment of two layers in an integrated circuit "detecting the first alignment mark and a reference mark using a wavefront sensing tool and forming thereof a first image," in combination with the rest of the limitations of **claims 1-2, 4-6**.

As to **claim 7**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in an alignment detection apparatus "an optical tool in the first light path, configured to detect an alignment mark in a layer on the semiconductor wafer; a wavefront sensing tool in the second light path" in combination with the rest of the limitations of **claims 7-15**.

As to **claim 16**, the prior art of record, taken alone or in combination, fails to disclose or render obvious a method for measuring the overlay alignment of at least two layers of a semiconductor wafer "aligning at least a portion of the semiconductor wafer containing a first and second alignment mark with the wavefront sensing tool," in combination with the rest of the limitations of **claims 16-22**.

As to **claim 23**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in a method of detecting the alignment of two layers in an integrated circuit “detecting a first alignment feature in a first layer of an integrated circuit using a wavefront sensing tool and forming thereof a first image,” in combination with the rest of the limitations of **claim 23**.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

Fax/Telephone Numbers

If the applicant wishes to send a fax dealing with either a proposed amendment or a discussion with a phone interview, then the fax should:

- 1) Contain either a statement “DRAFT” or “PROPOSED AMENDMENT” on the fax cover sheet; and
- 2) Should be unsigned by the attorney or agent.

This will ensure that it will not be entered into the case and will be forwarded to the examiner as quickly as possible.

Papers related to the application may be submitted to Group 2800 by Fax transmission. Papers should be faxed to Group 2800 via the PTO Fax machine located in Crystal Plaza 4. The form of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The CP4 Fax Machine number is: (703) 872-9306

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gordon J. Stock whose telephone number is (703) 305-4787. The examiner can normally be reached on Monday-Friday, 10:00 a.m. - 6:30 p.m.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

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November 13, 2003



Zandra V. Smith
Primary Examiner
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